

QUARTERLY REVIEW

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Geologic Investigation in the State of Utah

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UINTA AREA OIL PACE QUICKENS

by Howard R. Ritzma
UGMS Petroleum Geologist

Shell Oil Company No. 1 Miles, mentioned as a probable new producer in the May 1970 *Quarterly Review*, was completed in late May as the discovery well of the newly designated Altamont Field near the town of that name in Duchesne County.

The Shell discovery flowed on sustained production during most of that month at an average rate of 1,170 barrels of oil per day with no water; it

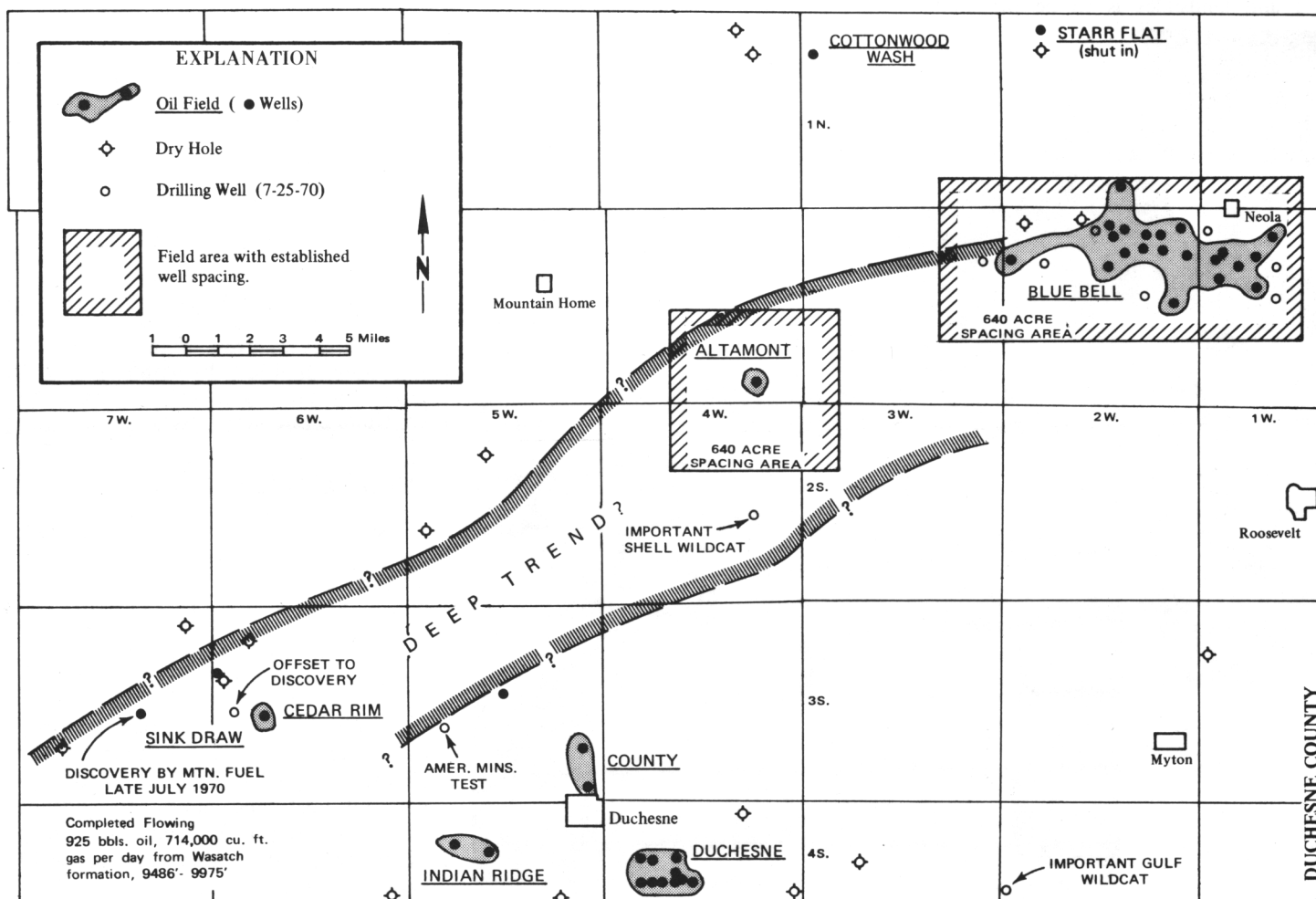
also flowed about 600,000 cubic feet of gas per day.

The oil is produced from perforations in a lower transition zone in the Green River Formation at depths of 12,910 to 12,942 feet. It is 41° API gravity, yellow-green and sweet, with a pour point between 100° and 105° F, but flows to the surface at temperatures well above pour point. High pressures indicate excellent productivity for the well.

Oil was recovered on tests of three shallower zones in the well and good shows of oil reported from four others. Presently none of the shallower zones is being produced commercially.

Altamont marks the fourth deep Green River oil discovery in Duchesne County in recent years. Bluebell Field, discovered in late 1967, was followed by Cottonwood Wash (Gulf, 1969) and Cedar Rim (Mountain Fuel, late 1969). Bluebell, up to mid-1970, has produced

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Geology Conditions Engineering

Active faults, expansive clays, landslides and solid waste disposal sites are under investigation by Bruce N. Kaliser, UGMS engineering geologist, this summer.

Fault studies centered along the Wasatch Fault, along which 80 percent of Utah's population lives, are focused on rift faulting in unconsolidated deposits to determine their engineering implications. It is hoped that sufficient field evidence can explain whether fault traces in relatively recent, unconsolidated, geologic materials are due to past earthquake activity or to a more normal compaction process. Siting of multistory buildings in the offing along the Wasatch Front could be critical in relation to the fault zone.

As the result of a formal agreement with the Morgan County Commission, a report on expansive clays and landslides is to be prepared

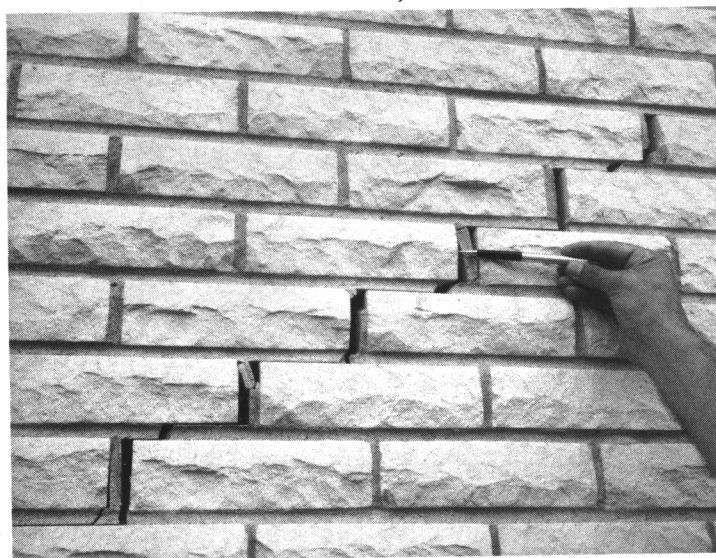
that will be used primarily in making decisions concerning subdividing. The construction of a new interstate highway joining the county with the Wasatch Front's commercial and industrial centers makes the investigation all the more urgent.

Up to the present, UGMS has been consulted *ex postfacto* on problems that arose from neglect of geologic conditions. An opportunity is afforded now to participate before problems materialize.

Except for geologic data to be obtained by UGMS, the State Department of Health's report on existing solid waste disposal sites in Utah is complete. A questionnaire, which consolidates a three-page federal form, was devised and prepared by Kaliser to add geologic input. Sites found hazardous by UGMS will be studied closely.

Ultimately, criteria for locating solid waste disposal sites may be established. A great increase in demand for new sites is anticipated in the near future because of new limiting statutes, expanding population, filling of old sites and a greater public awareness of environmental pollution.

The engineering implications of constructing on unconsolidated deposits (top) are visually defined (below).



(continued from page 1)

2.4 million barrels of oil since its discovery and now has 20 producing wells. The single Cedar Rim well produced 50,000 barrels in the first five months of production and reportedly was averaging 350 barrels per day.

Shell has received temporary 640-acre spacing for oil wells in a 25 square-mile area surrounding the well. Four miles south of the Altamont discovery outside the spaced area, Shell is drilling another deep test on what has been described as a "separate" prospect.

The Shell well which bottomed at 12,970 feet in the transition zone between the Green River and Wasatch (Eocene) formations has probably just scratched the surface. The total sedimentary section in this deep part of the Uinta Basin is estimated to be 30,000 to 32,000 feet thick.

JUST IN . . .

Mountain Fuel No. 1 Sink Draw, SWNE Sec. 22, T. 3 S., R. 7 W., Duchesne County, a wildcat test 4 miles west of the Cedar Rim discovery (see above) was completed in late July flowing 925 barrels of oil and 700,000 cubic feet of gas per day. Production is from four zones in the Wasatch Formation between 9,486 and 9,975 feet.

Gulf Oil drilling at No. 1 Tribal-Willow Creek, 7 miles southeast of Strawberry Reservoir in Wasatch County, recovered substantial amounts of oil and shows of gas on a test of an unidentified formation at 4,835 to 4,885 feet. The promising test may indicate another western Uinta Basin oil discovery.

Earnings Up

Kennecott Copper Corporation's earnings for the first quarter of 1970 established a new record high of \$56.8 million or \$1.71 a share. This surpassed the previous record set in the third quarter of 1969 when the company earned \$46.5 million or \$1.41 a share.

Factors in this net income improvement over a year ago were record copper prices, continued strong demand for copper and coal, and increased dividends from the Chilean El Teniente Mining Company, in which Kennecott has a 49 percent interest.

Fault Features Photographed

Scientists, real estate bankers and local and state government agency officials in attendance at the special meeting on geologic hazards held July 21 in the State Capitol's House Chambers heard and saw the preliminary results of an earthquake fault investigation and evaluation prompted by the recommendation of the Governor's Advisory Committee on Geologic Hazards for greater detailed fault mapping where urbanization is imminent.

The main focus of the study contracted for by UGMS was the hazard relating to fault displacement. Lloyd S. Cluff, vice president and chief engineering geologist of Woodward, Clyde and Associates, presented low-sun angle illumination aerial photographs of the Wasatch Fault from just south of Draper to Brigham City, Utah, from the report to UGMS. Positions of the fault were plotted on U.S. Geological Survey 7½-minute quadrangle maps.

This technique of photography uses low angle sun illumination to accentuate fault features. "The object is to use shadowing and lighting effects, produced by optimal sun illumination conditions, by photographing at the ideal time of day and year to enhance characteristic features which are difficult or impossible to see on conventional aerial photos," stated Cluff in his report to the group. The photo taken from the study illustrates its effectiveness in delineating landslides at the mouth of Ogden Canyon.

In the May 1970 *Quarterly*, p. 4, an article describes this landslide area and the potential problems that could have arisen from real estate development had not responsible planning taken into full account the geologic aspects of the site.

In his introductory remarks, William P. Hewitt, UGMS director, called the report "preventive medicine," a tool to



Aerial photograph of landslides at mouth of Ogden Canyon. Approximate scale 1:12,000.

be used by city and county planners in future urban development.

Following Cluff's presentation, UGMS engineering geologist Bruce N. Kaliser illustrated other geologic hazards in Utah with color slides, some only days old.

Gordon Harmston, director of Natural Resources for the state, presided over the meeting.

"S" Isotope — A Hydrogeologic Tool

UGMS staff member Bruce Kaliser presented a paper entitled "Sulfur Isotope Determination as a Geohydrologic Tool," co-authored by D. C. Grey, associate director of the University of Utah Isotope Geology Laboratory, at the Eighth Annual Symposium on Engineering Geology and Soils Engineering. The symposium was held at Idaho State University in Pocatello on April 1-3, 1970. Most of the water samples discussed in the paper were taken from the Bear Lake area.

The paper will be printed in the Proceedings of the Symposium to be made available in October.

Rock 13 Proves Lucky Take-Home

A moon rock brought back by the Apollo 12 crew apparently dates back to the formation of the solar system. G.J. Wasserburg of Cal Tech has firmly dated it as 4.6 billion years old -- the oldest rock known.

The specimen, known as rock 13, is granite-like and is the most radioactive rock yet found in the lunar specimens. Its age and composition seem to add to the evidence for an originally hot moon, for it can hardly have crystallized from any relatively transitory event such as meteoritic impact or cooling of a lava on the surface.

Oil/Gas Producers Pay Royalties

1969 royalty payments to the federal and state governments and to Indian tribes by oil and gas producers in Utah totalled over \$9.38 million. Payments were divided as follows*:

	Oil	Gas	Total
Federal Lands	\$2,959,500	\$462,300	\$3,421,800
State Lands	399,900	53,400	453,300
Indian Tribal Lands	5,171,400	336,100	5,507,500

Utah's largest oil field, Greater Aneth, is located mostly on Indian tribal lands in southeast San Juan County.

*Data from Division of Oil and Gas Conservation.

Testimony on Federal Land Leasing

Testimony was presented by the Utah Geological Survey to the U.S. Senate Interior and Insular Affairs Committee at hearings conducted July 13 at the State Capitol by Senator Frank Moss of the Minerals, Materials and Fuels Subcommittee. Under consideration were two proposed bills resolving problems of leasing federal lands on which oil-impregnated sandstone deposits are found. The magnitude and importance of Utah's oil-impregnated sandstone deposits were outlined briefly.

Utah's reserves were calculated to total between 20.5 and 29.7 billion barrels contained in about 49 individual or groups of deposits. Estimates of oil in place in principal oil-impregnated rock deposits of Utah presented to the committee are shown below (estimated by Howard R. Ritzma, UGMS).

The testimony concluded that the deposits, most of them mapped by the Survey since 1967, form an important part of the nation's future energy resources, and predicted some development of oil shale as an energy source in the decade 1970-80, probably before major development.

Deposits	Areal Extent (square miles)	Thickness of Pay (feet)	Overburden Thickness (feet)	Gross Oil in Place (barrels)
*Giant Deposits				
UINTA BASIN, NORTHEAST UTAH				
Asphalt Ridge*	20- 25	5-135	0- 500	1.0- 1.2 billion
Hill Creek	50- 70	3- 35	0- 250	300- 400 million
Lake Fork	4.0- 4.5	15- 70	0- 400	15- 20 million
P. R. Spring*	215- 250	3- 75	0- 250	3.7- 4.0 billion
Raven Ridge	20- 25	5- 35	0- 500	100- 125 million
Rimrock	2.5- 3.5	5- 90	0- 250	30- 35 million
Sunnyside*	20- 25	10-550	0- 600	2.0- 3.0 billion
Whiterocks	0.6-0.75	1000±	0- 500	65- 125 million
CENTRAL SOUTHEAST UTAH				
Circle Cliffs*				
East and west flank deposits in Moenkopi Formation	28	few-310	0-1800	1.0- 1.3 billion
Tar Sand Triangle*				Measured 2.3 billion
Elaterite Basin, Teapot Rock, Tar Cliff, Fault Point, Cove and Hatch Canyon deposits	200- 230	few-300+	0-2000+	Indicated 3.8 billion Possibly Present 12.0 billion Total 18.1 billion

UGMS TOURS AEC

AEC's Nevada test site was visited by Hellmut H. Doelling and Howard R. Ritzma, UGMS staff members, on April 13. The group making the trip included several members of the State Legislature, the director and selected staff members of the Department of Natural Resources, and officials of state health and highway agencies.

Included in the fast-moving tour were views of craters and subsidence areas marking underground tests of nuclear de-

vices in recent years and a trip deep underground into tunnel complexes where nuclear explosive testing is conducted.

Arranged by the Utah Department of Development Services, the trip was designed to give Utah officials first-hand knowledge of AEC operations on the sprawling test site, and particularly of operating practices and safety standards applied to nuclear testing conducted and proposed for other areas.

Transportation was provided by the Utah Air National Guard.

SOIL SAMPLES WEIGH ON SURVEY

"The only thing uplifting about this job is the tonnage," was one comment made describing the determined effort to reduce out-of-state material in the UGMS Library of Samples. The work has kept the crowded space in the lower south end of the Mines Building in turmoil for months.

Receipt of several large groups of oil well and mining test hole samples in 1969 taxed the limited space available in the library to the utmost. To make room, the library arranged to ship to Wyoming and New Mexico several thousand boxes of samples from wells drilled in those states. In return a few samples from Utah wells that had been lurking in dark corners of the Wyoming and New Mexico repositories were received. Also received was a scattering of samples from Nebraska, Montana and South Dakota wells. A complete set of samples from a well in Oregon has lain on the library's shelves unrecognized and uncatalogued for many years. Additional swapping of material is expected with Colorado in coming months.

The weighty job of sorting and removing the samples was accomplished by Larry Trimble, Bob Folsom and Sam Quigley, University of Utah students employed by UGMS in the sample library.

Eventually the UGMS sample library will be limited to an intermountain state collection -- Utah, western Colorado, Arizona, Nevada and Idaho. The great volume of change in material precludes issue of a supplement to the sample library catalog. Compilation of a new catalog is planned for early 1971 to include all changes in material effected in 1970.

Map Available

A colored, 3' x 4' geologic map of the Wheeler Peak and Garrison quadrangles, Nevada and Utah, by Donald H. Whitebread, is for sale by the U.S. Geological Survey, price \$1.00. An explanatory pamphlet accompanies the map (Map I-578).

ELECTRIC LAKE CHARGES INVESTIGATION

by R.T. Shuey and R.B. Smith
Department of Geological
and Geophysical Sciences

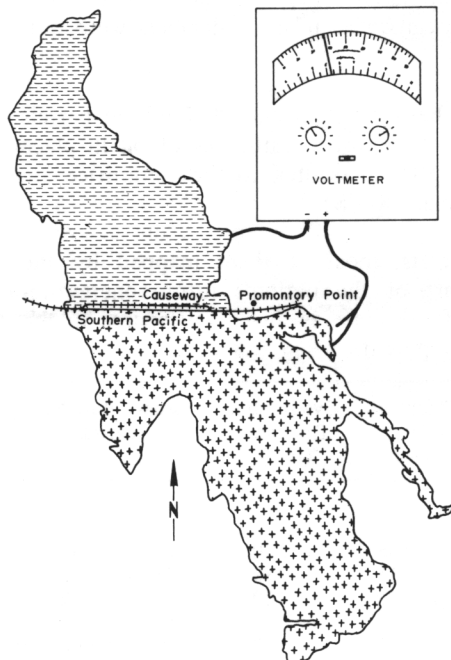
The idea that Great Salt Lake might be electrically polarized arose in a course of geophysical well logging at the University of Utah in the fall of 1969. In electric logging, formations can be characterized by a voltage (self potential) which depends in part on the salinity of the formation fluid.

The railway causeway built a decade ago divides the Great Salt Lake in two parts which now differ greatly in salinity. The same electrochemical theory used in well log interpretation predicted that there should be a voltage across this semipermeable membrane (the causeway) separating fluids of different ionic concentrations.

The two sections *do* differ in electrical voltage making the lake a giant battery.

The first known observation of the lake's electrical polarization was made in April 1970. A bare copper wire was dropped off each side of the causeway near Promontory Point and connected to a pocket voltmeter. The observed voltage averaged $\frac{1}{2}$ volt.

Conventionally, electrical power supplies have the red terminal positive, but here the red terminal (the reddish waters north of the causeway) had the negative



voltage. Fluctuations of .1 volt seemed related to wave action in the shallow water.

These observations were repeated in May and have been duplicated in the

laboratory by S.M. Breitling of the Department of Chemical Engineering.

We don't completely understand the lake voltage, but we do know it depends on the electrodes as well as the ionic concentrations. For example, with two aluminum electrodes, the voltage was only .02 volts.

It's highly doubtful we have discovered a significant source of free electrical power. In the first place, $\frac{1}{2}$ volt D.C. is not a convenient form. Secondly, when current is drawn the voltage drops instantly (in less than a second).

The highest power obtained was 50 microwatts. Perhaps this could be increased an order of magnitude using different electrodes, but it would still be inadequate to power even one light bulb. Agitation of the electrodes did not improve the power supply; however, it did not deteriorate perceptibly in time (five minutes).

Electrical measurements could be applied in the study of the lake's salt budget and corrosion processes. But it wouldn't be a "first." For years the Russians have been mapping the self potential in reservoirs to locate and evaluate leaks.

EARTHQUAKE EPICENTERS

General earthquake epicenters in or near Utah for March and April 1970, with dates of occurrence and approximate magnitude, are listed below. Unless otherwise indicated, localities are in Utah.

	Magnitude
March	
3 Near Cedar City.....	2.2
8 Green River Desert.....	3.1
10 South of Sunnyside.....	1.5
10 South of Sunnyside.....	1.8
11 Promontory Mtns.....	3.0
12 Near Salt Lake City.....	1.7
12 Near Salt Lake City.....	1.7
13 South of Sunnyside.....	1.6
13 Near Randolph.....	3.1
16 South of Sunnyside.....	3.1
17 Near Fillmore.....	2.4

19 Northern Utah-Nevada border	2.7
22 Promontory Mtns.....	2.9
25 North of Panguitch.....	2.8
25 Near Salt Lake City	2.0
26 Nevada Test Site (Handley)	6.3
29 Near Kelton.....	4.4
30 Southern Utah	3.0
30 Near Salt Lake City	<2.0
(Approximately 11 recognized rockbursts near Price, Utah, were of significant size to be recorded.)	

April	
1 South of Huntsville	2.1
2 South of Huntsville	1.6
3 North of Nephi.....	1.6
4 San Rafael Swell.....	3.1
5 South of Sunnyside.....	2.8
11 South of Sunnyside.....	2.0
18 Near Hanksville.....	3.8
20 In Wyoming, east	

of Logan, Utah	2.5
20 Southern Nevada-Utah border	2.8
21 Near Hanksville.....	2.3
21 Rangely, Colorado	4.0
21 Aftershocks, Rangely, Colorado, 8 events	1.5-2.3
22 Aftershocks, Rangely, Colorado, 7 events	1.6-2.0
23 Rangely, Colorado	2.4
25 South of Sunnyside.....	2.7
28 South of Sunnyside.....	2.8
(Approximately 16 recognized rockbursts near Price, Utah, were of significant size to be recorded.)	

These earthquakes were recorded by the University of Utah seismograph stations under the direction of Kenneth L. Cook. All locations and magnitudes are preliminary determinations; the final determinations will be printed in the University of Utah Seismological Bulletin, issued quarterly.

Recent Releases

BULLETIN 81

Lead-alpha and isotopic age determinations on Utah rocks are now available in Utah Geological and Mineralogical Survey's Bulletin 81, "Radioactive and Isotopic Age Determinations of Utah Rocks," compiled by James A. Whelan (cost,\$3.00).

The bulletin summarizes the findings of many individuals working in the Basin and Range. These investigators employed different methods of age determination at various laboratories. The Engineering Experiment Station and the Research Fund of the University of Utah provided financial assistance for lead-alpha investigations conducted by Professor Whelan.

BULLETIN 84

Bulletin 84, "A Directory of the Mining Industry of Utah," supplements the first directory published by the UGMS in 1965 which covered the industry through the year 1964. This,

the second directory, covers the industry through 1967 (cost, \$1.50).

The bulletin lists active mineral producers according to counties, and within each county according to commodity.

SPECIAL STUDIES 28

Harry S. Suekawa authored the study published as Special Studies 28, "Study of Kennecott Copper Corporation-Great Salt Lake Authority Tailings Test" (price, \$3.00). The feasibility of using mill tailings from Kennecott Copper Corporation as road base and dike material is investigated.

Conducted by the Great Salt Lake Authority, the test, started in 1965 and completed in 1968, was intended to answer two questions: (1) would the tailings stabilize under attack from lake waters at a 20:1 slope, and (2) would widespread dispersal of tailings occur and contaminate industrial and recreational areas.

SPECIAL STUDIES 31

Of particular economic import, P.R. Spring's oil-impregnated sandstone

deposit, Uintah and Grand counties, Utah, has been examined and evaluated in Special Studies 31 (cost, \$5.00).

"P.R. Spring Oil-Impregnated Sandstone Deposit, Uintah and Grand Counties, Utah," by William D. Byrd II develops the stratigraphy, exploitation methods and problems and economic factors of the area.

SPECIAL STUDIES 32

Condensations of papers presented at the Governor's Conference on Geologic Hazards in 1967 are the subject of Special Studies 32. Landslide, earthquake, construction and cloudburst hazards are authoritatively investigated and illustrated in the 21-page study, "Governor's Conference on Geologic Hazards, December 14, 1967."

As are all the above-mentioned publications, this study is available at the UGMS office on the University of Utah campus, Salt Lake City, Utah 84112.

If ordering by mail, remit cost plus 10 percent handling charges.

Lake Slate

The summer agenda for the UGMS "navy," the Clyman and the Gilbert, calls for fathometer studies in the south end of Great Salt Lake, drilling the salt crust in the north end, and a continuation of brine sampling throughout the lake.

Results of the fathometer studies showing depths of the water and contour of the lake's bottom will be used to compile a navigation chart of the lake. There is no such chart presently available.

Meanwhile, Chief Walter M. Katzenberger continues his battle to maintain

their working order despite signs of wear on both boats. A salt cake precipitated in the Clyman's engine necessitated running the engine four hours in fresh water to flush the accumulated residue. He is currently engaged in solving leakage problems which developed from worn rudder shafts.

Record Production

Mineral production value in Utah was \$539.1 million, a new record high, according to the Bureau of Mines, U.S. Department of the Interior. This value was \$90.2 million (20 percent) more than the previous high recorded in 1966, and \$115.2 million more than the 1968 figure. Value of the metals group increased \$104.4 million and showed losses only in the values of lead, silver and uranium.

All commodities, except natural gasoline in the mineral-fuels group showed increases in value. The group recorded an increase of \$7.8 million (8 percent) in value to a total of \$111.7 million.

Value of nonmetals decreased for 9 of the 14 commodities. Gains in the values of cement, sand and gravel, salt, lime, potassium salts, and stone increased the overall value by \$2.9 million.

Need for Action

Secretary-General U Thant stated in March the critical need for international action on the problems of human environment. Speaking at the opening session of the preparatory committee for U.N. Conference on Problems of Human Environment, he said "Control of these effects will require new economic thinking, new legal instruments, new administrative measures, and new governmental priorities." He said the conference "should be planned in a predominantly action-oriented manner." He estimated that the world's population will double in the next 25 years, doubling consumption of water, energy, and minerals as well.

Callaghan Honored

At the 1970 annual meeting held in Rolla, Missouri, April 27-30, Eugene Callaghan was elected honorary member of the Association of American State Geologists. Presently associate director of Utah Geological Survey, Dr. Callaghan served with Indiana's State Survey from 1946-49 and as director of the New Mexico Survey in 1949. He was retired recently as acting chairman of the Geological and Geophysical Sciences Department, University of Utah.

QUARTERLY REVIEW

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